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Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

THIS ISSUE

Lubrication of
Logging and
Sawmill Machinery

PUBLISHED BY
THE TEXAS COMPANY
TEXACO PETROLEUM PRODUCTS

TEXACO LUBRICANTS FOR LOGGING AND SAWMILL MACHINERY

LOG HANDLING

Steam Cylinders

For Superheat Conditions	Texaco Cavis Cylinder Oil
Above 150 lbs. pressure	Texaco Leader Valve Oil
125 to 150 lbs. pressure	Texaco Pinnacle Cylinder Oil
Below 125 lbs. pressure	Texaco Draco Cylinder Oil

Bearings

Sleeve type, oil-lubricated according to clearance and temperature	Texaco Anser, Aleph or Altair Oil or Texaco Bearing Oils
Sleeve type, grease lubricated	Texaco Cup Grease No. 3 or Texaco H Grease No. 1
Ball or roller type	Texaco Starfak Grease M or Texaco Marfak No. 2 Heavy Duty
Slides	Texaco Aleph, Altair Oil or Texaco Bearing Oils
Spur Gears	Texaco Crater No. 1X
Transfer Chains and Rails	Texaco Crater No. 1X or Texaco Crater No. 2X
Wire Rope	Texaco Crater A
Log Car Journals and Locomotive Parts	Texaco Bearing Oils or Car Oils
Rod Cups	Texaco Rod Cup Grease

Tractors and Trucks

Engines (according to manufacturer's recommendation)	Havoline Motor Oil Texaco D-303 Motor Oil or Texaco Motor Oil
Chassis Parts	Texaco Marfaks or Texaco Chassis Lubricants

(Continued on inside back cover)

LUBRICATION

A TECHNICAL PUBLICATION DEVOTED TO THE SELECTION AND USE OF LUBRICANTS

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Lubrication of Logging and Sawmill Machinery

"TIMBER", or as the colorful woodsman says — "Timbah" — is more than just a routine warning today, that a giant Douglas Fir is about to be felled where the Faller wants it to fall. "Timber" means building lumber, trim for the finished home, woodpulp for the paper mill. Timber is one of the most vital raw materials in the postwar reconstruction plan. The popular idea used to be that timber is a product of the Pacific Northwest and the States along the Canadian border. It still is, but the South today has made a definite bid as a competitive area, especially since the fast growing slash pine has been developed and proved to be applicable as wood pulp for the Southern paper mills. Southern pine also makes excellent building lumber.

THE NECESSARY MACHINERY

From forest to mill, the essential machinery includes —

- power saws
- yarder donkeys
- loaders
- shay engines
- locomotives
- tilting racks
- tractors
- log cars
- trucks and trailers

When the logs are delivered to the sawmill and the rough timbers to the planing mill, the following machines are used:—

- log carriages
- "shotguns"
- steam niggers
- kickers
- manipulators
- side rollers
- run-out tables
- band and circular saws
- resaws
- set works
- edgers
- gang saws
- trimmers
- slashers
- "hogs"
- lathes
- surfacers
- moulders
- planers
- motors and conveyors
- reduction gears
- steam engines
- saw filing machines
- air compressors

All this machinery requires synchronized operation; failure of any part to function effectually may react upon the production schedule. So logging and sawmill machinery is carefully maintained. Effective operation is further assured by reason of the fact that modern machinery is equipped with carefully designed bearings, gears and chains. Lubrication is a feature of the maintenance program.

When lubricants are selected according to their lubricating ability, when the operating conditions are considered, when the machines are regularly lubricated, maximum production is assured at minimum cost for maintenance. Among the most important factors in connection with lubrication in these industries, are the speed and accuracy of the work. Logs are sawed at almost unbelievable speed, with remarkable accuracy as to dimensions. These

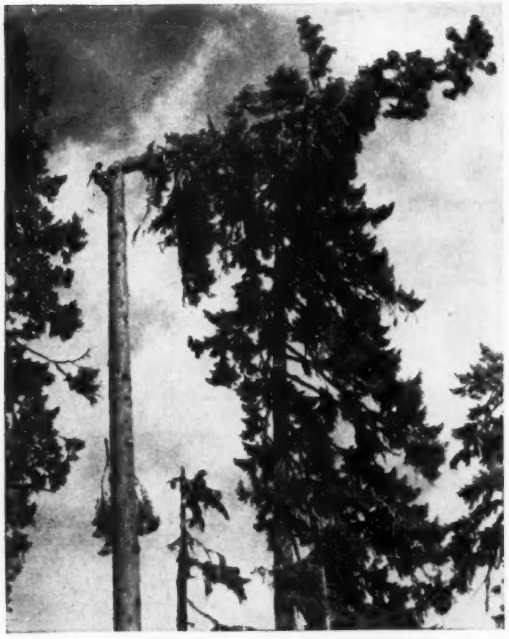

Photo by Kenneth S. Brown

Figure 1—Topping — An important operation, before the tree is felled.

requirements had much to do with improvement in the design of sawmill machinery. The conveyor builder also played a part; his mechanisms feed logs not only to the saws, but remove the timbers, boards or trim as fast as they are finished.

PORTABLE POWER SAWS

Portable saws may be built with an endless saw tooth chain or a circular cutting element.

The Chain Saw

In a portable chain saw the cutting element is held in cutting position by a guide bar, with the driving unit at one end and the tail-stock at the other. The modern chain saw used in the woods can be powered by either a two-cycle gasoline engine or an electric motor. Power transmission is attained by suitable reduction gearing.

Lubrication of the chain saw is very important; as this device in modern heavy logging operations is a key machine it must keep running. This requires careful attention to oiling the chain which is done from a reservoir in the tailstock; protecting the power transmission gearing with a suitable gear lubricant; and lubricating the power unit according to type and manufacturers' recommendations. Other parts which may be carried on ball bearings require a special anti-friction bearing grease.

Chain lubrication is especially important, for if it is not properly maintained, the unit cannot be run at full power. An automatic oiling idler serves this purpose, taking oil from a built-in reservoir. The viscosity of oil required for the saw chain depends upon the operating temperature — it may range from SAE 20 to 50.

The gasoline engine being of the two-cycle type requires that oil be mixed with the gasoline. Mixing should be done in a separate container so that a uniform solution is developed. Good practice avoids using the fuel tank for this purpose. A half pint of oil (SAE 30 to 50 according to climate) per gallon of gasoline (unleaded) is customary.

The Portable One Man Power Saw

This type of saw is used primarily for pulpwood and firewood cutting where one man operation is advantageous. This device also is powered by a gasoline engine; in contrast, however, the 4-cycle type is used wherein lubrication is similar to that in a conventional automotive engine.

The engine drives the saw through a connecting shaft and set of hardened steel driving gears. Lubrication of these latter requires a heavy duty grease compounded with an oil of comparatively heavy body so that leakage will be effectually resisted.

HANDLING THE LOGS

Power is a factor throughout the industry. Manpower for saw control when the trees are topped and cut. Steam, gasoline engine, Diesel, and to some extent, electric power when the logs are subsequently handled from the forest to the mill. Even water power is indirectly utilized when log rafts are floated down rivers to the sawmill.

Logs are moved from the woods to the mill according to the facilities available and the type of trees involved. In the fir and redwood areas the yarder is a vital unit at this stage of operations. It is powered by a gasoline or Diesel engine or sometimes by electric power. Other machinery includes a transmission and a suitable chain or gear drive to the hoisting drum. The entire mechanism is secured to a sled, made of two large logs fashioned as sled runners. A yarder is moved through the woods by its own power, a line from the drum being run to a stump, the unit skidded up to the latter, and so on until it is placed in the desired location.

When the yarder has assembled the logs at the "landing" they are loaded by the loader to railroad cars where rail transportation is used, or to trucks. Log hauling by trucks is most widely used today. The "landing" consists of a spar tree, either natural or erected by a rigger. Wire cable for hauling the logs is run from the yarder drum through blocks or pulleys on the spar tree. Yarders and loaders usually work from the same spar tree. The loader is similar to the yarder, though smaller.

In pine country no yarders are used, the logs being yarded by crawler tractors. Sometimes portable loaders go right into the woods, pick up the logs and place them on the load. In other words, the loader does some yarding, but usually the crawler tractor brings the logs to the "landing" where a portable loader makes up the loads on trucks.

Sledding with a crawler tractor over the snow and ice is practicable in winter in some Northern areas. Water transportation and log pond storage are of advantage in that dirt and stones are washed off and the logs go to the saws in wet condition. This leads to good sawing.

Where logs are handled to log pond storage they are floated one by one to a chain conveyor which extends from the log deck in the mill to beneath the surface of the pond. At this point, there is a spool or sheave around which the chain revolves. This chain is equipped with spikes or dogs which grip each log and carry it up to the log deck in the mill. The driving mechanism or log jack required to operate this chain is one of the heaviest duty machines in the mill. It requires a powerful reduction gear carrying the log deck sprocket wheel for the conveyor. This entire assembly is in almost continuous operation, but as it travels slowly, periodic examination and lubrication of the various parts can be readily made.

A steam kicker at the top end of the conveyor pushes the logs sidewise from the chain and onto the log deck. This latter slopes downward to the log carriage. A steam, air or electric "kicker" known as a "simonson" which is actually a log manipulator carries them onto the log carriage and then to the headsaw.

Whatever the log handling arrangements, the lubricating engineer is concerned with wire rope, steam cylinders, internal combustion engines, exposed gears and bearings.

PRIME MOVING POWER

Steam

Steam power became most applicable in the sawmill when the industry developed into the heavy production class. Wood fuel was available at little or no cost and lent itself readily to raising steam of the desired pressure in a short time.

Oils for steam cylinder lubrication are selected according to the nature of the steam, the engine design and the operating conditions. Wet or saturated steam predominates, the average pressure being around 200 pounds. Steam temperatures corresponding to pressures within this figure, coupled with the moisture content of the steam, require the use of a compounded cylinder oil ranging in viscosity from 125 to 175 secs. Saybolt Universal at 210° F.

Compounding is necessary to develop emulsifying or lathering qualities when mixed with water. Compounding means adding a certain percentage of animal fat — usually lard oil, tallow or degras —

Photo by Kenneth S. Brown

Figure 2—Modern Timber Falling — The power saw has come into general use in West Coast forests.

Photo by Kenneth S. Brown

Figure 3—Log pond storage on the lumber mill.

to a mineral cylinder stock. The resultant lather has excellent adhesive ability, so it covers the cylinder walls and valve seat surfaces with a tenacious film which effectively resists being washed off by the exhaust or by the continual rush of fresh wet steam. Only a few drops of such an oil delivered per minute by a mechanical force feed or hydrostatic lubricator will keep the average engine cylinders well lubricated and will reduce steam loss by blow-by past the pistons or rod packing.

The steam serves as the carrier and distributing medium for the oil. Cylinder oil must therefore be delivered to the steam by means of a properly designed atomizer which will enable the steam to break up the oil into minute particles and thoroughly disperse them throughout the body of the steam before it enters the valve chest and cylinder. The atomizer should be located a few feet above or in back of the throttle valve, in conjunction with a positive feed mechanical or hydrostatic lubricator.

Steam cylinder oils for this service should atomize readily under the prevailing pressures. This is an important point to remember where the lubricator inlet or atomizer may have to be located close to the throttle valve.

Inasmuch as it is desirable for the oil to be completely atomized by the time it reaches the latter, the relation of steam pressure to oil viscosity must also be understood. The higher the pressure the greater the temperature; in other words, the greater the viscosity-reducing effect and the more readily will atomization be accomplished. An oil of, say 135 seconds Saybolt Universal viscosity at 210° F. will, therefore, become thinner and more readily atomized by steam at 150 pounds pressure than by steam at 125 pounds.

It is general practice to regard 150 pounds steam pressure as the dividing line, using higher viscosity oils above 150 pounds and lower viscosity oils where steam pressure is consistently below 150 pounds. Ability of an oil to atomize also will vary directly with the amount of compound used. Lower viscosity oils (from 100 to 135 secs. Saybolt Universal) containing from six to ten per cent of compound such as degras or tallow, can, therefore, be expected to be best suited to the moderate pressure wet steam conditions which prevail.

The Tractor

In recent years the tractor has invaded the "woods" just as it has so many other industries where "pulling power" is a factor. The crawler type tractor has definite advantages in logging operations; it is mobile, can handle heavy loads over rough terrain and is economical to operate. Where the ground will permit, the tractor can be used to do all the yarding of logs to the loading point; it also can be used to supplement cable hauls to thereby reduce the need for "spar" tree rigging.

The crawler tractor also can be hitched to a device known as an "Arch". This unit raises the ends of the logs up by means of wire cable and winches on the tractor. Since the ends of logs are raised they can be hauled easier and a tractor can haul more logs. Lubrication of the arch tracks is similar to crawler tractor tracks, other plain bearings on the arch take regular pressure gun grease. Some operators use skid pans in place of arches. These pans are placed under the ends of the logs so they won't dig into the ground, thus the crawler tractor can pull more logs. Skid pans require no lubrication. Still other operators just pull the logs on the ground by the tractor without arch or skid-pans.

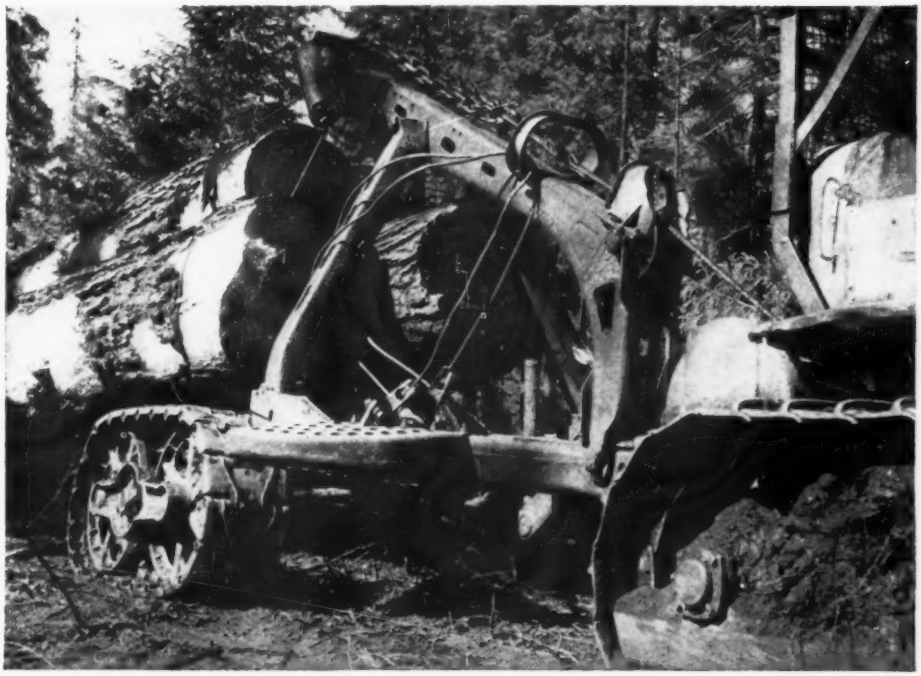

Photo by Kenneth S. Brown

Figure 4—The "Arch" in service with crawler tractor elements shown.

The Engine

Tractor lubrication and its relation to operation is of distinct interest to the logging industry. By reason of the nature of the fuel, power and fuel economy are extremely important. Engine performance and maintenance costs are directly related. Any tractor engine which is lubricated with an oil which has been selected with due regard to the operating conditions, will be best capable of developing full power with the greatest fuel economy.

Full power becomes possible only where there is maximum compression and a clean engine. Compression is chiefly affected by carbon deposits and uneven seating of the valves, the movement of the piston rings in their respective grooves and the extent to which they maintain the requisite seal between cylinder walls and piston to prevent "blow-by".

Piston rings take care of the more or less variable clearance which practically always exists between pistons and cylinders. These rings, therefore, must be able to move freely in their grooves. This can only be assured when they are free from carbon or gum deposits. Under such conditions, regardless of the age of the engine, or the variation in clearances compression losses will be practically negligible if the rings are not abnormally worn and if the oil film is of suitable thickness. On the other hand, rings which have worn unevenly, or become stuck due to carbon or gum formations, will reduce the power capacity of the engine and promote dilution of the crankcase oil by fuel blow-by.

Blow-by is objectionable in any engine. It will in all probability reduce, or, in many cases, wash off the lubricating film from the cylinder walls. The direct result may be scoring of the latter due to lack of lubrication, especially if dilution of the oil in the crankcase has occurred to an excess. Reduction in the lubricating ability of the oil film can easily lead to the consumption of more power in overcoming friction between the wearing parts of the engine. The thinner the oil due to dilution with fuel, the greater also will be the possibility of dangerous metal-to-metal contact between the turning parts and the main or connecting rod bearings.

Engines which require Diesel fuel will generally function at somewhat higher temperatures than a gasoline engine. This fact will naturally tend to aid in the attainment of more complete vaporization and offset the relatively low volatility of the heavier fuel. Yet it cannot do this completely; as a result, dilution is an ever present possibility and its effects must never be overlooked. In fact, crankcase dilution of the lubricating oil in any heavy-duty engine, using low-volatility fuels will be more prevalent than in the average automotive type engine which functions on gasoline. This is because Diesel fuel oils vaporize less completely than gaso-

Photo by Kenneth S. Brown

Figure 5—Loading Douglas fir logs for truck and trailer haul.

line; in consequence, the heavier unvaporized parts are ready and capable of exerting a solvent action upon the oil film on the cylinder walls and getting by the rings.

Track Roll Bearings

Crawler type track roll bearings require a considerable volume of lubricants, as application every eight hours, or every shift, is usually recommended when the equipment is operating. The conditions of operation are very severe as the tracks may be exposed continually to water-wash, mud or dust. The sleeve-type track end bearings must be given particularly careful attention due to the shock loads to which they are subjected. The most satisfactory lubricant for these bearings in warm weather is a grease containing a high viscosity mineral oil. In cold weather a grease of low temperature characteristics or a straight mineral oil is used.

Axle Design

Axle design is an important factor due to the tremendous loads involved. The double-reduction planetary-type drive axle is one of the significant developments which is facilitating truck operation today.

Where log trailers must be controlled over steep grades under full power, the rear axle assembly is the heart of the power transmission assembly. This assembly is made complete by the use of heavy-duty tapered roller bearings. Then, by completely enclosing the rear axle assembly in an oil-tight housing, bath lubrication becomes practicable, permitting the use of a quality extreme pressure lubricant which can meet the load conditions most effectually. Gear lubricants in this type of service should be drained, and the cases flushed and refilled every thousand hours.

Transmissions and Auxiliary Transmissions

In contrast with the differentials, the tooth loads on the transmission gears are considerably lower; this permits the use of a straight mineral gear lubricant of SAE 90 or 140 grade according to the temperature or an engine oil of corresponding viscosity, viz., SAE 40 or 70.

Resistance to oxidation and foaming should be most carefully considered when selecting automotive gear lubricants.

Truck and Trailer Wheel Bearings

Truck wheel roller bearings often may have to be lubricated under widely varying temperatures and operating conditions. In the woods in winter the atmospheric temperature may drop to −40° F. In contrast, in summer operation in southern climates the maximum hub temperature may exceed 250° F. Naturally, a satisfactory wheel bearing grease must be soft enough to furnish good lubrication at the lowest operating temperatures likely to

be encountered and yet have a texture which will prevent undue leakage at higher temperatures.

These intensive operating conditions require the production of wheel bearing lubricants to specifications which will conform to the expected temperatures. Due to the exceedingly heavy loads carried and the necessity for maintaining low speeds, water is commonly used to cool the brakes; it may cause trouble if the wheel bearing grease cannot withstand the washing action. Sodium base greases are best adapted to these conditions and are superior for heavy-duty wheel bearing lubrication because they have sufficiently high melting points to insure against separation or breakdown when exposed to the highest operating temperatures likely to be encountered in the wheel hubs. To meet this requirement a wheel-bearing grease for normal service should have a maximum usable temperature of at least 250° F. For low-temperature conditions a softer grease is preferred. In either case, the texture of the grease is a most important characteristic; if the texture is "right" there will be minimum possibility of leakage regardless of the temperature. A medium-heavy viscosity mineral oil in the grease is a factor in this regard. The percentage of sodium soap varies according to the oil viscosity and the desired consistency. Texture is a function of the ingredients and method of manufacture.

Truck Chassis Lubrication

A truck-chassis lubricant must conform to four important requirements:

1. Have lasting ability or long life.
2. Resist water washing.
3. Be adhesive, and
4. Form a protective seal to prevent entry of contaminating foreign matter.

Four basic types of greases are available for chassis lubrication, viz: calcium, sodium, aluminum or mixed base. The general range in consistency will be from semi-fluid to a stringy plastic.

Sodium base greases are preferred; they have the highest melting point of any of the above. Furthermore, they have the advantage of good stability and will not separate at temperatures in excess of some 350° F. While these greases are emulsifiable to some extent in warm water, solubility is negligible where the method of preparation is carefully controlled with respect to the viscosity of the mineral oil and amount and type of soap used. A sodium base grease of this type is unusually resistant to road wash and possessed of sufficient adhesiveness to form an effective seal around the chassis parts to exclude water, dust or sand; and to resist squeezing out and throw-off under road shocks and loads.

Wire Rope

Wire rope is a medium for power transmission in lumbering operations. Since logging is always an outdoor procedure, wire rope is continually exposed to the elements; load conditions are severe, and inspection is often difficult. All the while the rope must be dependable, otherwise hazard to the woods crew may develop and handling of logs to the sawmill would be retarded.

Wire rope operates at its best when the strands are protected against wear, rust and corrosion. Adequate lubrication gives this protection, consequently lubrication is one of the most important items in the lumberman's maintenance program. Lubrication begins with the selection of the lubricant, proper storage and intelligent application.

The service required of a wire rope controls its maintenance. The rigging for a "spar" tree is stationary and serves to guy the tree against excessive swing when shock loads are applied by the "yarding" or "loading" rig. The wire rope on the rig is movable, working over drums, much like the rope on a crane or hoisting engine. It is this movable rope which must be most carefully lubricated, for it is continually flexing as it runs round the drums. This develops friction between the strands; it also enables moisture to get into the interior of the rope. Rust or corrosion of strands at this point

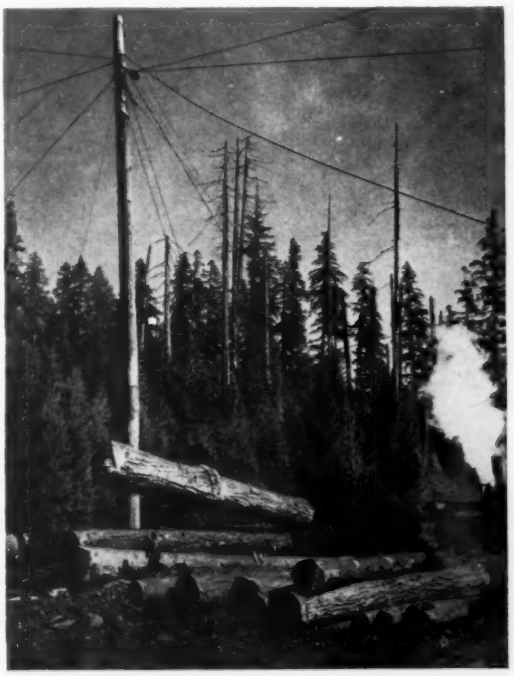

Photo by Kenneth S. Brown

Figure 6—Reloading — Note spar tree and use of wire rope.

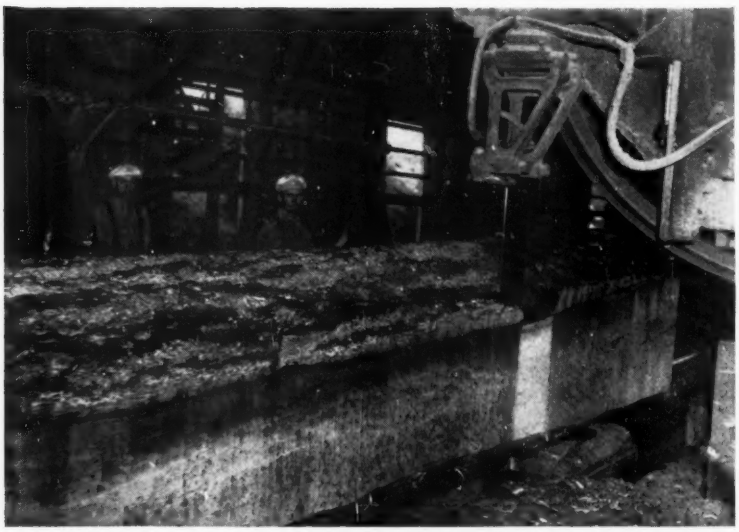

Photo by Kenneth S. Brown

Figure 7—The bandsaw in action.

is most serious, for it is difficult to detect. All the while the strands may be rapidly weakening.

In brief, wear will occur in any wire rope in service. It is impossible to absolutely eliminate friction between individual strands, the rope surface and the sheaves or winding drums, regardless of the suitability of the lubricant or the attention paid to lubrication, although a suitable lubricant can minimize wear. Also, deterioration through age or the effects of outside causes such as water or excessive heat can be offset by proper application of the right kind of rope lubricant.

Proper application means saturation of the core of a wire rope, and if the latter is not neglected after being put into service, it can be maintained at its maximum flexibility, with the core serving as an auxiliary source of lubricant supply.

A wire rope lubricant should never have a damaging effect upon the core fibres of the rope, for this will offset the lubricating ability. Products of a tarry nature which may contain a certain amount of acid would be detrimental and would fall in this category, yet in general appearance they might be very deceiving and similar to the more suitable straight mineral rope lubricant. Fillers such as flake graphite, asbestos, etc., also should be avoided for they will frequently be detrimental, especially if the rope is to be used under relatively low temperature conditions. Fillers may cause flaking or cracking of lubricating films in service to permit water or other destructive or corrosive materials to penetrate between the wires.

The most effective lubricants for wire rope are petroleum products in which consistency is a natural property. Lubricants of this type having a viscosity ranging from 500 to approximately 1000 secs. Saybolt at 210° F. will have a natural adhesive tendency and still be sufficiently fluid to assure of proper penetration.

A wire rope lubricant must never be too heavy or viscous otherwise its penetrative ability would be reduced. Then, while the exterior of a rope might seem to be effectively lubricated, the inner strands and core might lack the required amount of lubrication to prevent rusting and wear. And yet, many operators will have a tendency to treat their ropes with highly viscous gear lubricants which, while adequately adhesive, frequently cannot penetrate between all the wires or saturate the core to the desired extent.

Wire ropes can be relubricated in a number of ways. Troughs or split boxes through which the ropes can be passed during operation (if time permits) are very effective. Such containers can be filled to the necessary level with lubricant, heated if required.

Another method is to set up a barrel or drum above the rope so that the lubricant can drip from a suitable outlet valve. If practicable the container should be equipped with heating coils so that the temperature of the lubricant can be raised to make it flow more easily. Where such equipment is used, a brush for spreading, arranged so as to be relatively fixed in position and in contact with the rope, will be advantageous. By locating the bristles beneath the flow of fresh lubricant, they can be kept in saturated condition so that thorough spreading will be accomplished with the greatest economy.

Complete immersion insures perhaps the best penetration with the maximum of economy. But this requires removing the rope from the rig.

Lubricants for wire rope are very adhesive so they may be difficult to handle. As a result, means of application such as the split box container or trough of oil-tight construction through which the rope can be run, is a very handy device. Flexing or working the rope around drums or sheaves while the lubricant is hot and fluid enough to find its way between the wires and down to the core is also good practice.

Gears and Chains

Chain lubrication is quite like bearing lubrication as far as the requirements which will be im-

posed upon the lubricants are concerned. There is, however, more chance for lubricant to be thrown off from a chain link than from the average bearing, for, even though bearings may be themselves subject to rotary or reciprocating motion, this will not be so severe as the action of centrifugal force on a chain. This force always is important when exposed or semi-enclosed chains are to be lubricated. Centrifugal force will be greatest during the period of bending, as the chains pass over the sprockets. At such times, any lubricant on the outside surface of a chain may be thrown off, although this will depend upon the adhesive ability of the lubricant and the surface speed of the sprocket wheels.

Wear in any gear or driving chain mechanism may be indicated by noise. Noise in a gear case cannot be associated with heat for, as a general rule, there will be good ventilation in the housing which will help keep the temperature down. So any increase in operating temperatures will not be too obvious, even in extreme cases of faulty lubrication of gear teeth or chain link connections, for the exterior of the case will generally be fairly cool.

Nor is it practicable to test the temperature of a gear or chain by hand due to the hazard involved. Even if possible it would be no indication of the probable actual temperature at the contact surfaces. Development of noisy, clanking operation, however, is a decidedly positive indication that a gear or chain lubricant is not functioning as it should to prevent metallic contact and solid friction.

In gear operation there will be periods during which the lubricant will be inactive, for actual contact between the teeth will only occur when they are in mesh. To a somewhat lesser extent the load imposed upon a chain link connection will also be decreased on the slack side.

Weather conditions may impose an unusual and severe duty upon an open gear lubricant in logging service. Temperature variations, loads and the possibility of considerable lubricant contamination must also be considered. All this requires that open gear lubricants should be adhesive and resist washing with water, also able to withstand heat and cold without flowing to excess or becoming brittle. The petroleum industry, being fully aware of these requirements has studied the refinement of gear lubricants. By judicious selection of crude oil stocks, methods of blending, and the use of water-resisting materials, products of remarkable lubricating ability have been perfected.

Lubricating ability is dependent upon the viscosity, the adhesiveness and the ability to resist prevailing tooth pressures. Temperature will affect both viscosity and adhesiveness in the normal operation of logging machinery. Gears must function at atmospheric temperature, and the range may be wide, although there will be but little possibility of the lubricant being reduced in viscosity by abnormal heat developed in the gears themselves.

Low temperatures require more serious consideration. Under these conditions unsuitable lubricants will have a tendency to become hard or brittle. Specifically refined gear lubricants resist this reaction. The normal viscosity range for service on exposed gears will vary from approximately 500 to 1000 sec. Saybolt at 210° F., the higher figure being more nearly right to meet the usual requirements.

Enclosed Gears and Chains

Gears which are enclosed or built into a chain drive assembly (as in certain power transmission units) will usually require a more fluid lubricant. The average enclosed chain drive will involve comparatively low clearances between the connecting elements which go to make up the links. The lubricant must be capable of penetrating to all surfaces of contact between these parts; otherwise, abnormal wear will take place. Here an oil of about the same viscosity as a heavy steam cylinder oil, i.e., in the

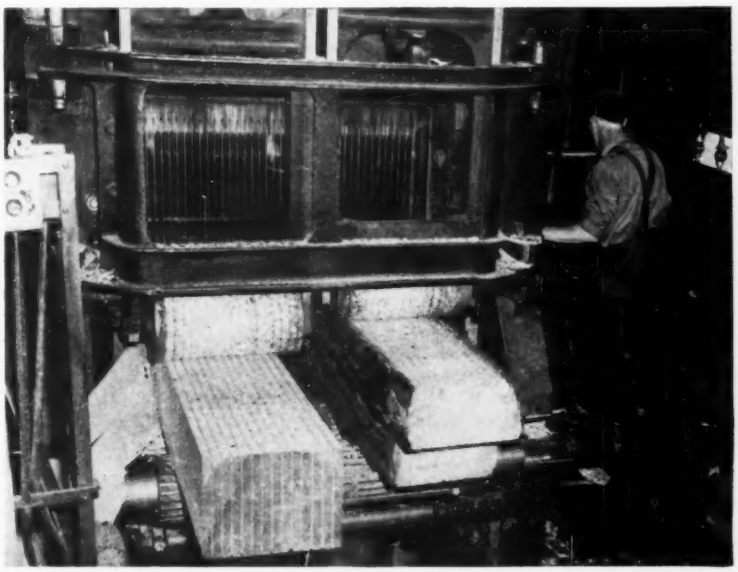

Photo by Kenneth S. Brown

Figure 8—Gang saw in a Douglas fir sawmill.

neighborhood of 150 to 200 secs. Saybolt at 210°F. is advisable. The lead soap base lubricants have proven very effective in this service.

SAWMILL OPERATIONS

Log-hauls or haul-ups handle logs from the log pond or store-yard to the saw-rigs. The log-haul drive is an important part of this unit. First sawing is done by the headsaw which is mounted in a headrig. A circular saw or a band saw is used in this rig. The latter is most commonly used in many localities for the first cutting which saws the logs into timbers, "cants" or slabs. In reality a band saw is a steel belt with teeth traveling around two wheels. It functions vertically and cuts on the downward side.

Band saws are from nine to sixteen inches wide and run at very high speed — usually around ten thousand feet per minute, a feature which is gained by mounting the arbor assembly on roller bearings. Obviously the band saw is expensive, so it must be carefully protected. That is why some mill operators often take the precaution of using small adjustable circular saws for making the initial cut. These take any damage to the blade which might result from rocks or sand imbedded in the bark. Lubrication, in turn, protects the machine parts and reduces maintenance costs. Band saws are designed for either single or double cutting.

The log carriage controls the motion of the log and its contact with the saw, running the log (end-on) up to the head saw and holding it in position for cutting.

Logs must be expertly handled at the head-rig and every operation under manual control must be executed without delay. Here the head sawyer determines the maximum of marketable lumber which can be cut from a log and the best relative position for the first cut; he also controls the speed of the head saw.

Resawing is done with a bandsaw or circular saw when the timbers or cants are to be cut into board thicknesses. Circular resaws may be arranged singly or in gangs. Circular saws are also used in the "edger" which trims the bark or rough edges from slabs or boards. Gang saws are built with their saw blades set parallel to each other.

Conditions which Influence Lubrication

The loads developed by the strains imposed in sawing must be considered in deciding upon the types of lubricants which will assure of most satisfactory operation of sawmill machinery. Of almost equal importance are the speed conditions and the necessity for studying bearing design to prevent lubricant contamination.

Both the bandsaw and resaw must operate under a heavy strain, for saw tension must be strong and uniform to prevent "snaking" or cutting of a non-uniform line. This strain is extended to the band-wheel arbor bearings. Lubrication requirements will vary according to this strain and the design of the bearings.

In band saw-wheel sleeve-type bearings which are subjected to some 2800 rpm wheel speed and a saw strain of around 35,000 lbs., oil must be directed to the bottom half of the upper wheel bearing and to the top half of the lower wheel bearing. Collar oilers are widely used for this purpose. These bearings carry all the load. Frequently they are water-cooled to maintain uniform temperatures. Under such conditions, a heavy straight mineral industrial machine oil is usually required.

Other types of band mill saws which have their arbor bearings equipped with anti-friction bearings require grease lubrication. A medium-bodied product (within the N.L.G.I.* No. 2 range) refined to meet the stability requirement so important in ball and roller bearing service should be used under such conditions. Greases of this nature possess a factor of safety in respect to their ability to function over a wide temperature range and strong resistance to oxidation.

*National Lubricating Grease Institute

Log Carriage Manipulation

The log carriage may be operated electrically or by steam. Improvements in electric motor bearing design have simplified materially the problem of lubrication on all electric-powered mill machinery.

Where steam is used the difficulties attendant to cylinder condensation, wet steam and frequently considerable pressure drop must still be considered. The steam driven carriage is operated by plunger mechanisms usually known as "shotguns." They are hand operated, so the valve motion must be sensitive, for they are worked continually by the sawyer. If they become dry, reduction in the cut will result. These valves present one of the most difficult lubricating problems in the sawmill. The secret is to provide an oil which will keep them as sensitive as possible; they rarely show any wear, but they must function at the slightest touch.

A highly refined, compounded steam cylinder oil is generally used having a viscosity range of 125 to 160 secs. Saybolt at 210°F. and a compound content of around five to ten per cent. This same oil can also be used on other steam operated mechanisms such as the "steam nigger" which turns the logs on the carriage. This oil will develop the necessary lathery film of lubricant and it can be readily handled by central pressure lubricating systems.

The devices that hold and adjust the logs on the carriage are known as dogs. They are operated by the set works. The power used is either hand,

electricity or air. Air-powered dogs present a lubrication problem in that — (1) they are usually quite remote from the main air source, and (2) there is usually considerable condensation due to the pressure drop which causes excessive rusting. This can be overcome by using a high quality lubricant containing a suitable fixed or fatty oil which will emulsify with moisture.

Carriage and Set Works

The bevel gears on the carriage drive the set works which control the cut. It is important that this mechanism work freely under all conditions or the lumber cut will vary in thickness; also a sluggish set works will reduce the total footage run through the mill. The bevel gears are usually enclosed and if the case is oil tight use an SAE 140 gear oil for summer and SAE 90 gear oil or SAE 40 motor oil in winter. Should the gear case leak a light grease can be used with satisfaction to stop leakage. Where the gears are exposed a suitable open gear lubricant can be used. The exposed screws which control the travel of the log blocks are best lubricated with a light cup grease containing graphite.

Edger-Trim Saw
Gang Rip Saw—Slashers

The extent to which these units are used depends upon the type of mill and the type of lumber being processed. The gang saws cut the "cant" or timber into more marketable sizes, or strips of from one to two inches thick. The gang saw consists of a row of saw blades set parallel in a vertical frame. It is driven by a crank through a connecting rod which imparts the necessary reciprocating or up and down motion. All parts must be rigidly constructed, as it is desirable to saw several "cants" into boards simultaneously.

The gang saw crank must be very carefully lubricated. It is another mechanism which carries a heavy load, and so becomes subject to considerable heat. Pressure lubrication is, therefore, desirable. If it is not employed, a compound engine oil is used in some mills in conjunction with a spray of water projected on the crankpin bearing. Others use their regular cylinder oil.

Edger mandrels require a lubricant which will stick tenaciously and resist being thrown off. The arbor bearings, in turn, may be either collar-oiled, water-cooled sleeve bearings, or of anti-friction type. The latter are provided for grease lubrication. In either case lubrication is relatively automatic and protected against contamination by sawdust. The same holds true for the modern feed and press roll bearings.

CONVEYORS

In every phase of the lumber industry there is a chance to use some form of conveyor to good advantage. From the log pond to the handling of finished marketable products a conveyor is used to move materials to and away from the saws, to the kiln buggies and to points of storage. The chain type of conveyor has proved its adaptability to this service. "Live" rolls are also used. These are rolls under constant rotation, being driven through a power transmitting connection. "Live" rolls are very effective in handling logs up to the headrig.

Lubrication

Lubrication of conveyors involves protecting the various bearings against undue wear or excessive corrosion. Abrasive foreign material causes wear; water causes rust and corrosion. Lubrication materially reduces these detrimental effects by maintaining a protective film on the contact surfaces of the moving parts.

Either oil or grease can be used for lubrication according to the design of the roll bearings. Where sleeve-type bearings are involved, oil lubrication by means of cups, or ring or collar oilers is usually required. Grease cup or pressure gun lubrication is equally as effective especially if high clearances prevail. Wherever ball or roller bearings are used, grease is generally required.

Chain Conveying

The pintle link principle is used in chain conveyors designed for log handling and sawmill service.

Grease lubrication by pressure gun has proved to be very protective in such chains. By cutting away the link within, a grease chamber is developed which holds a reserve supply for protection of both the pin and link surfaces. This careful consideration has been given to lubrication in the realization that wear (by entry of abrasive foreign matter) may seriously mar the contact surfaces of the links.

KILN DRYING

After all the necessary sawing has been done, lumber is prepared for the market by kiln drying to evaporate most of the moisture it contains. Kiln drying is a mechanical process of aging or seasoning. It is most essential to the production of uniform grades of materials and the prevention of subsequent warping or shrinkage. So boards, after they leave the gang saws, edgers and trimmers are loaded onto kiln trucks and passed into steam-heated dry kilns.

Kiln seasoning accomplishes the same results as air drying in the open, but in far less time as it is carried out at a temperature from 240 to 340°F. From sixty to seventy-two hours are required, according to the character and thickness of the lumber whereas air drying would take many weeks. Due

to the continued high temperatures involved, kiln truck axle bearing lubrication is important. Grease lubrication by means of a pressure gun is generally used as it is felt to give best protection of the axle bearings. The operating conditions require the use of good anti-friction characteristics which will stand comparatively high temperatures. By using such a lubricant, there will be best assurance against grease breakdown, and formation of detrimental deposits. The heavy oil content in turn assures that such a grease will stay put and resist leakage when exposed to kiln temperatures while the cars are in the kilns.

Kiln fan bearings are akin to electric motor bearings, so they are lubricated in a similar manner. Frequently they are of anti-friction type. Wherever the installation may be exposed to high temperatures it will be advisable to use a grease comparable with that suggested for the kiln cars. Where oil lubrication is necessary, a medium to heavy-bodied straight mineral oil should be used according to temperature conditions. Wick oilers are applicable to the lubrication of these bearings.

AIR COMPRESSORS

Lubrication of air compressors in sawmill service is important due to the possibility of sawdust being drawn into the system with the intake air. For this reason the air intake as well as the compressor should be located in such a manner as to preclude entry of sawdust. An added precaution is to install a suitable air filter at the intake. With these precautions mill compressor cylinders can normally be lubricated effectually with a highly refined straight mineral compressor oil of around 300 seconds Saybolt Universal viscosity at 100°F.

Successful performance of an air compressor is contingent upon:

1. Controlled lubrication—to insure positive feed of just sufficient oil to lubricate the cylinders properly. This can be judged by the condition of the valves and cylinders.
2. Clean cold air — to reduce inlet temperatures as far as possible, and to prevent dust and dirt from entering the system.
3. Suitable intercoolers, and an aftercooler — of sufficient size to permit condensation of oil mist and moisture carried over by the compressed air.
4. A receiver — also to remove condensed oil vapor and moisture.
5. A low carbon residue lubricating oil — within the viscosity range desirable to meet the operating temperatures, piston ring tension and bearing clearance.

ELECTRIC MOTORS

Sawmill motors may be equipped with ring oiled plain bearings, or ball or roller bearings.

Ring Oiler Requirements

The ring oiler on a heavy-duty motor bearing is an automatic oil circulating device of the most simple type. It stands hard service, but can become inoperative due to contaminated or unsuitable oil, for the ring must hang freely on the shaft if it is to turn and carry oil to the top. Any gumming or accumulated foreign matter in the ring slot may interfere with this movement. If the ring becomes stuck, it may lead to starved lubrication and a bearing renewal job if not corrected. This makes it advisable to flush and refill all ring-oiled bearings every one or two months according to how dusty the operating conditions may be.

Highly refined straight mineral oils are recommended for ring oilers — oils which are resistant to oxidation and gumming. Normally a viscosity range of from 150 to 500 secs. Saybolt Universal at 100°F. is desirable. It is especially advisable to specify low pour test so that the oil will not become too sluggish in cold weather to keep the rings from turning freely.

Motor Ball or Roller Bearings

Grease lubrication prevails on these bearings. There is considerable responsibility attached to the selection of greases for a ball or roller bearing as a precision mechanism is involved which can be damaged severely by corrosion or loss of seal. Accordingly, a ball or roller bearing grease must be primarily a specialty lubricant, composed of highest quality ingredients and designed to resist breakdown when subjected to oxidizing conditions. Such a product must also resist separation of the oil and grease leakage from the bearing.

CONCLUSION

Logging and sawmill operations have come a long way since the log cabin days of our forebears who were the first woodsmen in the country. Today the industry is organized and man-control has largely succeeded man-power. Along with this organization of the industry has come the use of the most economical methods of power generation, elimination of unnecessary steps in handling the material, marked reduction in waste, and realization that power consumption, regardless of the machine, is directly related to lubrication. The Petroleum Industry has contributed to this progress by intensive research, by preparation of lubricants which, when selected to meet the operating conditions, will keep machines running when it is most essential for them to run.

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TEXACO LUBRICANTS FOR LOGGING AND SAWMILL MACHINERY

(Continued from inside front cover)

IN THE MILL

Bearings	
Sleeve type, oil-lubricated according to clearance and temperature	Texaco Aleph, Altair Oil or Texaco Bearing Oils
Sleeve type, grease lubricated	Texaco Cup Greases or Texaco H Grease No. 1 or No. 2
Ball or Roller Bearings	
Oil lubricated	Texaco Regal Oil A (R&O) or Texaco Regal Oil B (R&O)
Grease lubricated	Texaco Regal Starfaks or Texaco Marfaks
Slides, Guides or Ways	Texaco Aleph, Altair Oil or Texaco Bearing Oils
High Speed Driving Gears	Texaco Meropa Lubricants
Live Rolls	
Bearings	Texaco Cup Grease No. 3
Bevel Gear Drives	Texaco Mine Car Grease No. 1 or Texaco Track Roll Lubricant, Light
Speed Reduction Units	Follow Manufacturers' Recommendations
Kiln Car Axles	
Grease lubricated	Texaco Marfaks
Oil lubricated	Texaco Cylinder Oil used in mill
Kiln Fan Bearings	
Oil lubricated	Texaco Alcaid, Algol or Ursa Oils
Grease lubricated	Texaco 919 Lubricant-S
Racks, Pinions and Exposed Gearing	Texaco Crater No. 1X or 2X
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